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Changing Concepts of Mind

ROGER W. SPERRY

A little exploring in the field of brain and behaviour will quickly reveal that brains, and particularly human brains, possess two rather special properties (not found in other systems so far as we know) that always have been notoriously difficult for science to deal with even in principle. The first of these, of course, is *conscious awareness*. Science has always found consciousness to be a will-o'-the-wisp, something that it cannot find, cannot demonstrate, measure, or work with, and in most cases, something just the general nature of which it cannot even satisfactorily conceive or imagine. How the brain mechanisms generate conscious experience remains today the number one problem in brain research, and one of the most truly mysterious phenomena left in the whole of science.

The second brain property that science finds particularly troublesome is *free will*. Science is concerned generally with causal relations, and can hardly work out the natural laws to predict and understand the behaviour of systems that fail to obey the principle of lawful causation. One of the earliest rules of animal behaviour stated that when an animal is brought into the laboratory and a given stimulus applied, under conditions where all input can be strictly and fully controlled, then one can predict that the animal will respond 'as it damn pleases'.

Back in the thirties, this was known on the East Coast as the Chicago Law of Behaviour; in Chicago, we referred to it as the 'Harvard Law'.

It is curious and perhaps not entirely coincidental that practically all of us consider these same two properties to be the two most important and most highly treasured of all our brain faculties. When we have lost consciousness, we have lost most of what makes everything worthwhile, and much the same can be said for the ability to will our own movements and actions and behaviour from moment to moment as we choose. To those who look to science for advanced insight and understanding, it must come as something of a letdown to discover that the preferred and main strategy that science has come up with for dealing with these two most challenging, interesting, and precious of all brain properties is, in both cases, to simply ignore or to actively renounce them – to the extent even of expressly denying that either consciousness or free will actually exists as a real phenomenon.

Since the advent of behaviourism in this country near the turn of the century, and the adoption of dialectical materialism in Russia, the prevailing doctrine of twentieth-century science has been that conscious mind and free will are little better than introspective illusions. According to neuroscience, all brain activity, and therefore all behaviour, is causally controlled and the causal agents and forces are entirely material or physical, i.e., biochemical, physiological, electrical, and so on, and definitely not mental or metaphysical.

A fundamental premise of neuroscience holds that a complete explanation of brain function is possible, in principle, in purely objective, physiological, and biophysical terms without any reference to subjective experience. The objective description of science has no place and no need for the likes of inner conscious

experience, nor is there any place in the whole brain-behaviour system where all operations are not at all times causally determined. Psychiatry informs us that our slightest slips of tongue, neurotic twitches, and other mannerisms, even our dreams, can all be shown to have their underlying causes, if one probes deeply enough. Through post-hypnotic suggestion, it can be shown that actions assumed by the subject to have been carried out spontaneously of his own free will were in fact preinstructed in detail before witnesses in a prior hypnotic session that the subject was then instructed to forget.

In other words, in the scheme of science, real freedom to act and choose is only an illusion, and the whole value-rich world of inner subjective experience is set aside as a passive, impotent by-product, a parallel correlate or just an internal-interior aspect of the one prime material brain process. Or in some cases, the conscious mind has even been explained away entirely as just a spurious pseudo-phenomenon conjured into our thinking as an epistemological artifact. What remains of the human psyche and the mind of man, in the behaviourist scheme, and in that of materialist science generally, seems to boil down essentially to a highly complex sequence of neuro-bio-physical interactions all causally determined and physically controlled.

The resultant view of human nature and the kinds of values that emerge from this are hardly uplifting. Most of the colour and quality and higher meaning of life are lost or destroyed and the longstanding separation between the material world of science, on the one hand, and the world of the humanities and inner experience, on the other, becomes wider and seems irreconcilable. The behaviourist renunciation of conscious mind and free will, flying as it does in the face of common experience and common aspiration, does little to counter the current waning of

intellectual confidence in science and feeds instead the rising sentiments of anti-science.

Attempts to make the behaviourist position more socially persuasive, as in the writings of B.F. Skinner (1), prove provocative perhaps, but hardly compete in appeal with some of the more common humanistic approaches. All of us would prefer to think that we are more than mere puppets of our brain's physiology, and that the inner experience that we live with most of our waking life is something real and significant – and perhaps, for large numbers of us, even something immortal or reincarnate, or capable of precognition, psychokinesis, and other psychic powers. Whatever the final answer, much is obviously at stake. Whole ideologies, world views, and value systems stand or fall on the outcome. If the stand of behaviourism and materialist science is, after all, correct (and certainly science has proven itself many times against other popular impressions), then much can be said for facing up to the realities of materialism and, like the Communist world, trying to build our society, life goals, and values around and within a philosophy of materialism.

That this is indeed the direction in which science is leading us begins to look now not nearly so inevitable as was the case only a dozen years ago. The reason lies in a modified interpretation of the nature of conscious mind and its relation to the brain mechanism, an interpretation that, since its appearance about ten years ago, has come to acquire considerable acceptance and support. This new interpretation, or better, reformulation, which I will now outline very briefly, involves a direct break with established behaviourist doctrine that amounts to an almost full reversal of the central premise on which the behaviourist movement was founded: instead of renouncing or ignoring conscious mind, the new interpretation gives full recognition to inner conscious awareness as a

high-level directive force or property in cerebral function. The conscious mind no longer is set aside as a passive correlate, but becomes instead an essential working part of the brain process.

The phenomena of inner experience on these new terms become causal determinants in brain activity. Conscious experience is thus understood as having a use, a reason for being, and a reason for having evolved in a material world. Accordingly, terms like 'mental imagery' and 'visual, verbal, auditory images' become acceptable now, with some caution, as explanatory constructs. After more than fifty years of strict avoidance on behaviourist principles, such terms have virtually exploded into wide use in recent years in the scientific literature dealing with perception, cognition, and other higher functions. We now hold that a full account of brain function is not possible in purely biophysical terms that do not include these higher mental entities.

Without attempting here a detailed account of the philosophical arguments, the evidence, and general background out of which the revised interpretation arose, let me just state briefly that the current interpretation conceives consciousness to be an 'emergent' property of neural events generated at top levels in the brain hierarchy (4). To it is attributed a regulative control role in and over the brain's neurophysiology. The control relation is based in the universal power that any whole exerts over its parts.

Mental phenomena as emergents, built of high-order cerebral operations, are conceived to act as wholes or entities in brain dynamics. As high-level dynamic entities, the brain's mental processes envelop and control their component neurophysiological, biophysical, molecular, atomic, and other elements, in the same way, for example, as the organism as a whole controls the fate of its separate organs and cells, or just as the molecule as a whole

overrides its component atoms, electrons, and other subatomic parts in any chemical reaction. As is the rule for part-whole relations, a mutual interaction between the neural and the mental events is recognized. The brain physiology determines the mental effects, as is generally agreed, but also the neurophysiology is at the same time reciprocally controlled by the higher organizational properties of the enveloping mental operations.

In case it is not already evident it should be emphasized that the current swing in psychology and neuroscience away from materialism and back in the direction of mentalism does not carry us all the way back to a metaphysical, dualistic, or supernatural brand of mentalism. The present is an intermediate compromise in which conscious experience still remains necessarily bound to the living material brain as an inseparable property of the brain in action.

This mind-brain reformulation has brought important changes also in our interpretation and outlook regarding free will. The causal sequence of brain events that leads to and determines any given voluntary act no longer is conceived as just a series of neurobiophysical activities. The emergent mental phenomena must also be taken into account and included among the controlling causes, and this introduces new degrees and kinds of freedom into the brain's decision-making process. For example, one's subjective desire to do this or that, along with other subjective feelings and motivations, and subjective values of all kinds, plus the whole range of cognitive mental faculties, may now enter into play as acceptable causal factors. These conscious mental phenomena override and supersede the component physiological and biophysical events in any decision to act.

Any given volitional response may depend also on things like the memory and the mental perspective

acquired by the person, and any of his consultants, over a span of many decades preceding the given act. Data from the information store of one or more libraries may be called on and funneled into the brain code sequence that leads up to the given choice. Even factors like the predicted long-term future consequences of the various alternative choices being contemplated may be included in this vast complex interaction that leads to the volitional decision to act. Compared to the kinds of determinism that science deals with in other systems, the degrees and the levels of freedom in the operations of the human brain clearly set the brain and the mind of man apart and give it the dignity of an apex post in the universe, far above all other known systems in terms of freedom to choose and to control a course of events.

Even so, one may object that our brain's decisions are nevertheless all, in a sense, determined, even though at this higher, more complex, mental level. Having *degrees* of freedom, in other words, does not quite make for *complete* freedom from causal control. The answer here is that complete freedom from causation would mean behaviour based purely on chance, on caprice, and would result in chaos. What one wants in free will is not complete freedom but rather the kind of determinism that allows one to control one's own actions according to one's own wishes, one's own judgement, perspective, cognitive aims, and other mental inclinations. This, of course, is exactly what is provided in our current interpretation.

These changing concepts of mind and free will substantially alter the general image of man and his role as drawn by science, and also bring other major departures from long established behaviourist-materialist tradition. When subjective values are conceived to have objective consequences in the brain they no longer can be shut off in a realm outside the domain of science. The old dictum that

'science deals with facts, not with values,' or that 'value judgements lie outside the realm of science,' no longer applies in this new framework. That whole dichotomy in which the world of science is restricted on principle to the cold, objective, quantitative, and materialistic, while all of the subjective, qualitative, and colourful humanistic aspects of life are relegated elsewhere, is now negated.

Old metaphysical dualisms and the seemingly irreconcilable paradoxes that formerly prevailed between the realities of experimental brain science and those of inner experience become reconciled today in a single comprehensive and unifying view of mind, brain, and man in nature. We pass conceptually in a single continuum within the brain from the brain's lower subnuclear particles up through atoms, molecules, cells, and successively higher levels to brain circuit systems without consciousness to those special high-order cerebral processes with consciousness.

Instead of separating science from values, the present interpretation (when all the various ramifications and logical implications are followed through) leads to a very different, almost diametrically opposed philosophy in which science is upheld as man's best hope in the search for ultimate value. Science becomes the best source and method for determining meaning and finding those ultimate ethical axioms and guiding beliefs to live and govern by. In other words, what has been called 'scientism' gets a new boost, now acquiring added dimensions, a new potency, and a new look and appeal. Science emerges as the most effective and reliable means by which the human brain can reach an intimate understanding and rapport with those forces that control the universe and created man – conceived, of course, in terms of scientific evidence. With metaphysical approaches excluded, no other alternatives compare with modern science for determining what is

ultimately good, right, and true.

Rather than elaborate further on this humanistic fall-out from brain research – and this is just the beginning of an entire new story (2) – I now turn back to brain research itself and look at some recent evidence, observations, and general data that have helped to direct our thinking. Specifically, I will quickly run through some of the effects of dividing the brain surgically down the mid-line, including results that seem to show that conscious experience is tied not only to the living brain but, more specifically, to certain neural systems at the upper brain levels.

When the fibre cables that link right and left neocortex are surgically sectioned in animals or in human patients with advancing intractable epilepsy, the unified world of inner experience seems also to be divided into two separate right and left systems, each apparently conscious in its own right but unaware of the experiences of its partner within the same cranium. The normally unified perception of the field of vision, for example, is divided into two separate inner visual worlds, one in each of the disconnected hemispheres, and each cut off from any direct intercommunication. Nowhere else in the brain do we come quite so close to linking higher conscious functions to specific neural systems.

Further, the surgically separated hemispheres in man are found to utilize different modes of perceptual and cognitive processing. This left-right differentiation in mental processing can be studied to advantage in the commissurotomized, or split, brain where it is possible to measure and to compare the positive performance of each hemisphere functioning independently. Direct comparisons can be made for performance on the same task in the same individual where life history and other background factors are equated, and the two hemispheres can be pitted against

each other for response dominance. Under these conditions, fine differences can be measured and qualitative distinctions discerned that are much more difficult or even impossible in comparisons involving different persons. One hardly notices if different people with brain damage tend to think a little differently; but it becomes most compelling to see the same individual performing the same test task in very different ways, and with different strategies, depending on whether he is using his left or his right hemisphere.

Repeated examination has consistently confirmed the strong lateralization and dominance for speech, writing, and calculation in the disconnected left hemisphere in right-handed patients. The minor, right hemisphere, by contrast, is unable as a rule to respond in speech or writing. Nor can it typically perform calculations except for simple additions up to sums less than 20. The language-dominant hemisphere is also the more aggressive, executive, leading hemisphere in the control of the motor system. After the surgery, these patients seem to run primarily on the left hemisphere. This is the hemisphere that we mainly see in action and the one with which we regularly communicate. It is apparently the highly developed and dominant capacities of the left hemisphere that are largely responsible for earlier impressions that cerebral functions persevere with little impairment in the absence of the commissures.

The mute, minor hemisphere, by contrast, seems to be carried along as a passive, silent passenger who leaves the driving of behaviour mainly to the left hemisphere. Accordingly, the nature and quality of the inner mental world of the silent right hemisphere remains relatively inaccessible to investigation, requiring special testing measures with nonverbal forms of expression. Although some authorities have been reluctant to credit the disconnected

minor hemisphere even with being conscious, it is our own interpretation based on a large number and variety of nonverbal tests that the minor hemisphere is indeed a conscious system in its own right, perceiving, thinking, remembering, reasoning, willing, and emoting, all at a characteristically human level, and that both the left and the right hemisphere may be conscious simultaneously in different, even in mutually conflicting, mental experiences that run along in parallel.

Though predominantly mute and generally inferior in all performances involving language or linguistic or mathematical reasoning, the minor hemisphere is nevertheless clearly the superior cerebral member for certain types of task. These are, of course, all nonlinguistic, nonmathematical functions. Largely they involve the apprehension and processing of spatial patterns, relations, and transformations. They seem to be holistic and unitary rather than analytic and fragmentary, orientational more than focal; and they seem to involve concrete perceptual insight rather than abstract, symbolic, sequential reasoning.

From the findings on hemispheric specialization it would appear that our educational system and modern society generally (with its very heavy emphasis on communication and on early training in the three R's) discriminates against one entire half of the brain. I refer, of course, to the nonverbal, nonmathematical, minor hemisphere, which we find has its own perceptual, mechanical, and spatial mode of apprehension and reasoning. In our present school system, the minor hemisphere of the brain gets only the barest minimum of formal training, essentially nothing compared to the things that we do to train the left, or major, hemisphere. A more detailed and comprehensive account of the studies on hemispheric differences in the surgically separated

hemispheres was presented recently in the Neurosciences Third Study Program (3).

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